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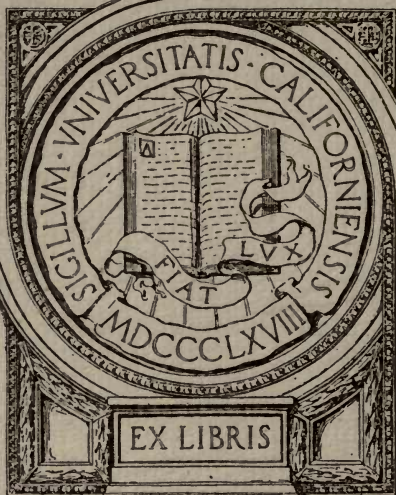
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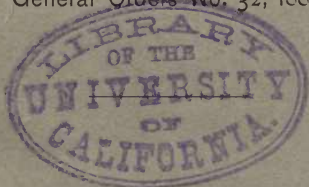
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WAR DEPARTMENT:
SIGNAL SERVICE, U. S. ARMY.

INSTRUCTIONS TO
RAINFALL OBSERVERS

OF THE
SIGNAL SERVICE, U. S. ARMY.

General Orders No. 32, 1887.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1887.

Signal Office,

GENERAL ORDERS }
No. 32. }

WAR DEPARTMENT,

Washington, May 25, 1877.

The following instructions to Rainfall Observers, Signal Service, U. S. Army, are published for the information of all concerned. They will take effect July 1, 1887.

BY ORDER OF THE CHIEF SIGNAL OFFICER:

J. MITCHELL,
2d Lieutenant, Signal Corps, U. S. Army.

OFFICIAL:

2d Lieutenant, Signal Corps, U. S. Army.

NOTE.—This copy of Instructions to Rainfall Observers should be kept *neat and clean*.

When an observer is relieved from duty, or is temporarily absent from his station, he will turn these instructions over to his successor, obtaining his receipt for the same, and will forward this receipt, by mail, to the observer in charge of the section center.

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Instructions to Rainfall Observers,

SIGNAL SERVICE, U. S. ARMY.

To increase the value and accuracy of reports of the stage of water in the larger navigable rivers of the United States, for the benefit of commerce and river navigation, and in order to render accurate flood predictions possible, the Chief Signal Officer has inaugurated a system of stations to be designated as Rainfall Stations.

These stations will be located at suitable points on the watersheds, at the sources, and on the principal tributaries of these rivers. They will be furnished with a rain-gauge and measuring-stick to enable the observers to report at stated times the amount of rainfall.

INSTRUCTIONS.

1. The duties of rainfall observers will consist in measuring and recording, at 2 P. M. each day, the amount of rain that has fallen during the preceding 24 hours, and entering it on a weekly form (postal card) prepared for the purpose. The week will end with Friday, on which day the observer will, after taking his observation and recording it, deposit the report (card) in the mail, addressed to Observer, Signal Service, U. S. Army,-----, in charge of the section, who will receive it the following day in time to furnish full press reports to such of the newspapers as desire to publish the information.

2. A monthly report will also be made on Form 180, which will be filled up from day to day, as soon after the observation has been taken as possible, and mailed to the observer in charge of the section at-----, on the first day of the succeeding month. A copy will be kept at the rainfall station.

3. The data obtained through this system of observations being for the public use, rainfall observers are authorized to furnish to all persons desiring the same, without expense to the United States, such information as their records afford.

4. The pay of observers will be 10 cents per day.

5. Rainfall stations will be arranged in sections, and each section-center will receive the reports from the several special stations and disseminate the information so as to subserve the best interests of the public.

6. With rare exceptions, rainfall observers will receive all their instructions from, and render all reports and bills for services to the observers in charge of their respective sections.

7. Observers should bear in mind that, in the acceptance of appointments as such, they become the authorized agents of the United States Government, and also that they are amenable to the laws governing the same, so far as their duties as rainfall observers are concerned.

8. Each rainfall station will be supplied with:—

- 1 Rain-gauge, standard pattern, including overflow attachment.
- 2 Rain-gauge measuring-sticks.
- 500 Forms 203.
- 25 Penalty envelopes, official.
- 100 Forms 180*b*, Weekly Reports (postal card).
- 25 Forms 180, Monthly Reports.
- 15 Forms 9, Vouchers.
- 30 Forms 8, Vouchers.

RAIN-GAUGE.

9. The rain-gauge consists of three parts, the collector, the receiver, and the overflow attachment. The precipitation entering the collector passes down into the receiver, and should the receiver become full of water before a measurement is made the excess flows from the receiver into the overflow attachment. The parts of the rain-gauge are shown in the following drawings:

Fig. 1.
Front View.

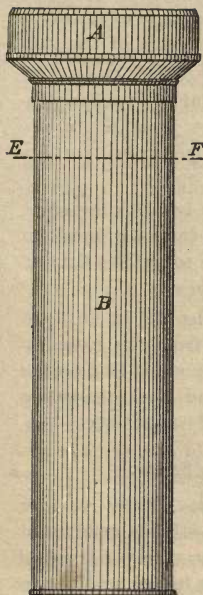
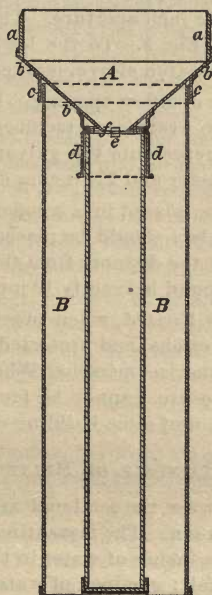


Fig. 2.
Vertical Section.



RAIN GAUGE

Fig. 3.
Receiver.

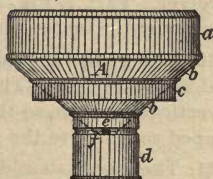
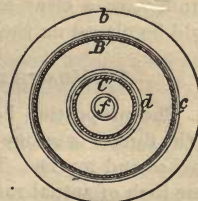


Fig. 4.
Horizontal Section, E-F.



0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 INCHES.
SCALE.

Description of the Standard Signal Service Rain-gauge:

- A. Receiver.
- B. Overflow attachment.
- C. Collector.

Fig. 1 shows the front view of gauge complete. Fig. 2, the vertical section. Fig. 3, front view of detached receiver; and Fig. 4, the horizontal section. Part *a*, in Fig. 3, is a brass rim 8 inches inside diameter, $2\frac{1}{4}$ inches deep, beveled to a sharp edge with one-fourth inch bevel. This brass rim is soldered to a galvanized-iron funnel with a three-quarter inch aperture. The angle of funnel is shown in vertical section, Fig. 2. To the lower edge of the funnel is attached a galvanized-iron sleeve, marked *d* Fig. 3.

Part *e*, Fig. 3, shows the overflow opening. Part *c*, Fig. 2, represents the point where the overflow attachment joins on to the receiver. Part *b*, Fig. 1, represents the galvanized-iron overflow attachment, 6 inches diameter and $22\frac{1}{4}$ inches deep.

10. The gauge should be placed in a wooden box, 8 x 8 inches, and 20 inches long. This box should be placed in the ground, in a vertical position, so that the distance from the top of the funnel-shaped collector to the ground is exactly 12 inches.

11. The gauge should be located, when practicable, in an open space, free from all obstructions, and protected from the interference of animals and unauthorized persons. When a position on the ground, with a clear exposure, cannot be found, the rain-gauge should be placed on the roof of some building of easy access.

TO MEASURE RAINFALL OR MELTED SNOW.

12. The proportion between the sectional areas of the receiver and the funnel is as one to ten. The measuring-stick is graduated in inches and tenths. Ten inches of water in the receiver is equal to one inch of actual rainfall; one inch of water in the receiver to one-tenth of an inch of rain; and one-tenth of an inch of water in the receiver to one-hundredth of an inch of rain.

13. First take off the top (or funnel-shaped collector) of the gauge; then, holding the measuring-stick in a perfectly upright position, insert it into the receiver. Upon removing the measuring-stick it will be found that it is wet up to a certain mark. If this mark on the stick is *one-tenth* of an inch it will indicate *one-hundredth of an inch* of rainfall; if the mark is *eight-tenths* of an inch on the stick it shows *eight-hundredths of an inch* of rainfall; if *one inch and three-tenths* on the stick the amount of rainfall is *thirteen-hundredths of an inch*, &c.

14. After measuring the amount of rain or melted snow, *empty the receiver*, place the top or funnel-shaped collector securely upon it, and put the gauge in position.

15. Should the amount of rain that has fallen be so great as to have filled the receiver and flowed into the overflow attachment, first measure the amount in the receiver, then empty, pour the water from the overflow attachment into the receiver, measure this amount, and the sum of the two measurements will be the total rainfall.

16. In case of snow, the measurements should be made in the following manner: Remove the gauge from its position and place it near a warm stove. As soon as the snow has melted measure the water in the receiver, and the amount will be the snowfall; empty and replace the gauge.

17. In addition to measuring the amount of snowfall *since last observation*, a measurement will be made of the actual depth, in inches, *of the snow on the ground*, selecting for this purpose some locality where the amount of fall is about the average. Drifts must be carefully avoided. The period during which the snow fell will not be taken into consideration in making *this measurement*.

18. When an observation is telegraphed, the words, one, two, three, &c., as the case may be, will be added to Form 203, to indicate the depth of snow on the ground, as explained in the second example under paragraph 24. For instance, if the average depth of unmelted snow on the ground is 5 inches, the observer should write the word "five" in the proper space on Form 203; if the snow measured 14 inches, the word "fourteen" would be written, &c. These words (one, two, three, &c.) must always be written and not given in figures.

19. Whenever any public property at a rainfall station has become unserviceable by reason of ordinary wear and tear, or otherwise, such as breakage by accident, the observer should immediately notify the observer in charge of the section-center, by letter, of the fact, giving the name of the unserviceable article and the nature and extent of the damage. The observer in charge of the section-center will then communicate with the Central Office, and request instructions in regard to the disposition to be made of the property. In no case will unserviceable public property be thrown away, but it will be held until orders are received from the Chief Signal Officer concerning its disposition.

20. All telegraphic reports will be written in duplicate on Form 203. One copy will be handed the telegraph operator, the other copy retained by the rainfall observer and disposed of as explained in paragraph 30.

21. Each report will consist of 6, 7, or 8 words, address and signature included. The first space will contain the word observer; the second space, the name of the place to which the report is to be telegraphed; the third space, the station from which the report is telegraphed; the fourth, the day of the month; the fifth, the cipher-word expressing the amount of rainfall, if any. When the rainfall between observations exceeds four inches, two cipher-words will be used—one (the fifth) to express four inches, and one (the sixth) to indicate the difference between four inches and the amount measured at the observation.

FOR EXAMPLE.

If, in the past 24 hours, 5.62 inches of rain has fallen, write on Form 203, in the proper space, the word Rutledge, which indicates 4 inches, then add the word Relator, which indicates the remainder, namely, 1.62 inches.

22. When snow is on the ground, a seventh word will be used to express the number of inches.

23. The last word in every report will be the surname of the observer.

24. The foregoing telegraphic reports will be sent in cipher, in accordance with the system given under paragraph 36.

The following is an example of an enciphered report, with the translation:

EXAMPLE:

[Form No. 203.]

WAR DEPARTMENT, SIGNAL SERVICE, U. S. ARMY.

*Report of Observations taken at Ottawa, Ill., on July 15th, 1887, 2 P. M.
75th Meridan Time.*

1	2	3	4	5	6
Observer.	St. Louis.	Ottawa.	Fifteenth.	Rufus.	Jones.
7	8				

Received at 1.10 P. M., July 15, 1887.

Sent at 1.12 P. M.

SMITH, *Operator.*

JONES, *Observer.*

Operators will send only the matter inside the heavy lines, without address or signature.

TRANSLATION:

Observer— } Address of Signal Service observer at St. Louis, Mo.
St. Louis— }

Ottawa—Name of Rainfall Station.

Fifteenth—Date of the month.

Rufus—Amount of rainfall—3.79 inches.

Jones—Name of the observer.

The following is an example of an enciphered report followed by the translation, when two cipher-words are sent for rainfall, and the amount of snow on the ground is given :

EXAMPLE :

[Form No. 203.]

WAR DEPARTMENT, SIGNAL SERVICE, U. S. ARMY.

*Report of Observations taken at Ottawa, Ill., on Jan'y 21, 1887, 2 P. M.
75th Meridian Time.*

Observer.	St. Louis.	Ottawa.	Twenty-first.	Rutledge.	Retail.
Eleven.	Jones.				

Received at 1.13 P. M., January 21, 1887.

Sent at 1.17 P. M.

THOMAS, *Operator.*JONES, *Observer.*

Operators will send only the matter inside the heavy lines, without address or signature.

TRANSLATION :

Observer— }
St. Louis— } Address of Signal Service observer at St. Louis, Mo.

Ottawa—Name of Rainfall Station.

Twenty-first—Date of the month.

Rutledge—Amount of rainfall—4.00 inches.

Retail— “ “ “ 2.66 “

Total, 6.66 inches.

Eleven—Depth of unmelted snow on the ground—11 inches.

Jones—Name of observer.

25. The regular observation at _____
will be taken at _____, ____ M., local time, which corresponds to
2 P. M., 75th meridian time.

26. When the rainfall in the past 24 hours equals or exceeds
one inch, a full report of the observation, as before explained, will
be enciphered on Form 203 and telegraphed to Observer, Signal
Service, U. S. Army, _____

27. The report WILL NOT be telegraphed unless the rainfall
equals or exceeds that stated in paragraph 26.

28. Attention is invited to the time of taking these observations.
All observations of the Signal Service are taken on 75th meridian
time. In paragraph 25 is given the *local time* at which these ob-
servations are to be taken.

29. To explain how the rainfall is entered on Forms 180 and 180b, the following example is given:

After measuring the water in the rain-gauge, as previously explained, it is found to measure six hundredths of an inch; this should be entered in its proper column on the Form as .06; fifteen hundredths should be entered as .15; twenty hundredths, as .20; one inch and twenty-five hundredths, as 1.25. Care will be taken to have the *decimal point* in its proper position.

30. Care must also be taken to enter on Form 180 all observations made,—they being needed to audit the bills of the observers. On the first day of the month succeeding that during which observations have been taken, each rainfall observer will mail to Observer, Signal Service, U. S. Army, ----- all retained copies of Forms 203, and a bill for services as rainfall observer during the month.

31. Bills for services as observer will be made on Forms 8 and 9. The instructions on the back of said forms will explain the manner of their preparation.

32. Observers will not prepay telegrams on official business, as settlement with the telegraph companies will be made by this office.

33. All telegrams will be marked "COLLECT, GOVERNMENT RATE."

34. Observations will be made on Sundays and holidays, as on other days, and at the regular hours.

35. All necessary blank forms will be supplied by the observer in charge of the section-center.

36. Cipher-words to indicate the amount of Rain or Snowfall.

These words will be used only when the amount of rain or melted snow is *telegraphed*.

In inches and hundredths of an inch.

0.01 to 0.49 inches.

0.01 Rabbit
0.02 Rabble
0.03 Raccoon
0.04 Race
0.05 Racer
0.06 Rack
0.07 Racket
0.08 Racy
0.09 Raddock
0.10 Radiant
0.11 Radiate
0.12 Radical
0.13 Radish
0.14 Radius
0.15 Raffle
0.16 Raft
0.17 Rafting
0.18 Rag
0.19 Rage
0.20 Rageful
0.21 Ragged
0.22 Ragman
0.23 Raid
0.24 Rail
0.25 Railing
0.26 Rain
0.27 Rainbow
0.28 Rainless
0.29 Rainy
0.30 Raise
0.31 Raisin
0.32 Rake
0.33 Raking
0.34 Rally
0.35 Ramage
0.36 Ramble
0.37 Rampage
0.38 Rampant
0.39 Ramrod
0.40 Ramson
0.41 Ranche
0.42 Rancid
0.43 Rancor
0.44 Random
0.45 Range
0.46 Ranger
0.47 Rank
0.48 Rankness
0.49 Ransack

0.50 to 0.99 inches.

0.50 Rap
0.51 Rapid
0.52 Rapine
0.53 Rapture
0.54 Rascal
0.55 Rash
0.56 Rashly
0.57 Rashness
0.58 Rat
0.59 Rather
0.60 Ratity
0.61 Ratio
0.62 Ration
0.63 Rattle
0.64 Ravage
0.65 Ravel
0.66 Raven
0.67 Ravish
0.68 Rawley
0.69 Raymond
0.70 Razor
0.71 Reaching
0.72 Read
0.73 Reading
0.74 Ready
0.75 Really
0.76 Ream
0.77 Reap
0.78 Rear
0.79 Reason
0.80 Rebate
0.81 Rebel
0.82 Rebound
0.83 Rebuff
0.84 Rebuild
0.85 Rebuke
0.86 Rebut
0.87 Recall
0.88 Recast
0.89 Recede
0.90 Receipt
0.91 Receive
0.92 Recent
0.93 Reception
0.94 Recess
0.95 Rechange
0.96 Recite
0.97 Reckless
0.98 Reckon
0.99 Reclaim

Less than 1 inch of rainfall.

Cipher-words to indicate the amount of Rain or Snowfall.

These words will be used only when the amount of rain or melted snow is *telegraphed*.

In inches and hundredths of an inch.

1.00 to 1.49 inches.

1.00 Reclasp

1.01 Recline

1.02 Reclining

1.03 Recluse

1.04 Recoil

1.05 Record

1.06 Recount

1.07 Recourse

1.08 Recover

1.09 Recruit

1.10 Rector

1.11 Recur

1.12 Recusant

1.13 Red

1.14 Redden

1.15 Redeem

1.16 Redoubt

1.17 Redound

1.18 Redraw

1.19 Redress

1.20 Reduce

1.21 Reed

1.22 Reef

1.23 Refer

1.24 Refill

1.25 Refine

1.26 Refit

1.27 Reflect

1.28 Refloat

1.29 Reflux

1.30 Refold

1.31 Reforge

1.32 Reform

1.33 Refrain

1.34 Refresh

1.35 Refuge

1.36 Refund

1.37 Refusal

1.38 Refuse

1.39 Refute

1.40 Regain

1.41 Regal

1.42 Regard

1.43 Regatta

1.44 Regent

1.45 Regiment

1.46 Region

1.47 Register

1.48 Regrade

1.49 Regret

1.50 to 1.99 inches.

1.50 Regular

1.51 Regulate

1.52 Rehash

1.53 Rehearse

1.54 Reject

1.55 Rejoice

1.56 Rejoin

1.57 Rejudge

1.58 Relapse

1.59 Relate

1.60 Relation

1.61 Relative

1.62 Relator

1.63 Relax

1.64 Relaying

1.65 Release

1.66 Relent

1.67 Relenting

1.68 Reliance

1.69 Relic

1.70 Relief

1.71 Relieve

1.72 Religion

1.73 Relish

1.74 Reload

1.75 Reluctant

1.76 Rely

1.77 Remade

1.78 Remain

1.79 Remake

1.80 Remand

1.81 Remark

1.82 Remedy

1.83 Remember

1.84 Reminder

1.85 Remiss

1.86 Remit

1.87 Remnant

1.88 Remodel

1.89 Remold

1.90 Remorse

1.91 Remote

1.92 Remotely

1.93 Remount

1.94 Removal

1.95 Remove

1.96 Render

1.97 Renerve

1.98 Renew

1.99 Rennet

Between 1 and 2 inches of rainfall.

Cipher-words to indicate the amount of Rain or Snowfall.

These words will be used only when the amount of rain or melted snow is *telegraphed*.

In inches and hundredths of an inch.

2.00 to 2.49 inches.

2.00 Renown
 2.01 Rent
 2.02 Rental
 2.03 Replace
 2.04 Repack
 2.05 Repaint
 2.06 Repair
 2.07 Repast
 2.08 Repay
 2.09 Repeal
2.10 Repeater
 2.11 Repel
 2.12 Repent
 2.13 Repine
 2.14 Replacing
 2.15 Replant
 2.16 Replete
 2.17 Repleven
 2.18 Replevy
 2.19 Replunge
2.20 Reply
 2.21 Report
 2.22 Reposal
 2.23 Repose
 2.24 Repress
 2.25 Reprieve
 2.26 Reprint
 2.27 Reproach
 2.28 Reproof
 2.29 Reprove
2.30 Reptile
 2.31 Repugn
 2.32 Repulse
 2.33 Repute
 2.34 Request
 2.35 Require
 2.36 Rescind
 2.37 Rescue
 2.38 Research
 2.39 Resend
2.40 Reserve
 2.41 Reset
 2.42 Reship
 2.43 Reside
 2.44 Resident
 2.45 Resign
 2.46 Resin
 2.47 Resist
 2.48 Resolute
 2.49 Resolve

2.50 to 2.99 inches.

2.50 Resort
 2.51 Resound
 2.52 Resource
 2.53 Respect
 2.54 Respite
 2.55 Respond
 2.56 Response
 2.57 Rest
 2.58 Restful
 2.59 Resting
2.60 Restless
 2.61 Restore
 2.62 Restrain
 2.63 Restrict
 2.64 Result
 2.65 Resume
 2.66 Retail
 2.67 Retainer
 2.68 Retake
 2.69 Retard
2.70 Retire
 2.71 Retort
 2.72 Retouch
 2.73 Retrace
 2.74 Retreat
 2.75 Retrench
 2.76 Retrieve
 2.77 Return
 2.78 Reunion
 2.79 Reveal
2.80 Revenge
 2.81 Revenue
 2.82 Reverse
 2.83 Revert
 2.84 Review
 2.85 Revince
 2.86 Revise
 2.87 Revival
 2.88 Revive
 2.89 Revoke
2.90 Revolt
 2.91 Revolve
 2.92 Rewake
 2.93 Reward
 2.94 Rhubarb
 2.95 Ribbon
 2.96 Rich
 2.97 Richly
 2.98 Richness
 2.99 Rickets

Between 2 and 3 inches of rainfall.

Cipher-words to indicate the amount of Rain or Snowfall.

These words will be used only when the amount of rain or melted snow is telegraphed.

3.00 to 3.49 inches. *In inches and hundredths of an inch.* 3.50 to 4.00 inches.

3.00 Riddance

3.01 Riddle

3.02 Ride

3.03 Ridge

3.04 Riding

3.05 Rife

3.06 Rifle

3.07 Riggs

3.08 Rigging

3.09 Right

3.10 Rightful

3.11 Rigid

3.12 Rigor

3.13 Rimple

3.14 Ring

3.15 Ringle

3.16 Rinse

3.17 Riot

3.18 Ripen

3.19 Ripley

3.20 Ripple

3.21 Rise

3.22 Risk

3.23 Rival

3.24 River

3.25 Roach

3.26 Roadway

3.27 Roaming

3.28 Roars

3.29 Roast

3.30 Roasting

3.31 Robbery

3.32 Robin

3.33 Robe

3.34 Robert

3.35 Robust

3.36 Rocky

3.37 Roddy

3.38 Rogers

3.39 Rogue

3.40 Roll

3.41 Rolling

3.42 Roman

3.43 Romance

3.44 Roof

3.45 Root

3.46 Rope

3.47 Rosary

3.48 Rosette

3.49 Rosland

3.50 Ross

3.51 Roster

3.52 Rostrum

3.53 Rosy

3.54 Rotary

3.55 Rotate

3.56 Rotten

3.57 Rotunda

3.58 Rough

3.59 Roughly

3.60 Round

3.61 Rouse

3.62 Rousing

3.63 Route

3.64 Routine

3.65 Roving

3.66 Row

3.67 Rowdy

3.68 Royal

3.69 Rub

3.70 Rubbage

3.71 Rubber

3.72 Rubbing

3.73 Rubbish

3.74 Ruby

3.75 Rudder

3.76 Rude

3.77 Radeness

3.78 Ruffian

3.79 Rufus

3.80 Rugged

3.81 Ruinous

3.82 Rule

3.83 Ruling

3.84 Rummage

3.85 Rumor

3.86 Rumpus

3.87 Run

3.88 Running

3.89 Ruption

3.90 Rural

3.91 Ruskin

3.92 Russell

3.93 Russia

3.94 Rust

3.95 Rustic

3.96 Rusty

3.97 Ruth

3.98 Rutland

3.99 Rutter

Between 3 and 4 inches of rainfall.

* 4.00 Rutledge

All cipher-words must be printed distinctly.

* When the amount of rainfall since last report exceeds four inches, two or more words must be used to express it, as "Rutledge," "Recede," which would indicate 4.89 inches.

U.S. Signal of- 368061

QC925
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Office.
Instructions to rainfall
observers.

368061

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